

Dzung X. Vo, Katarina Tabi*, Manreet Bhullar, Andrea Johnson, Jake Locke, Sophia Wang, S. Evelyn Stewart and Sheila K. Marshall

Mindful awareness and resilience skills for adolescents (MARS-A): a mixed-methods study of a mindfulness-based intervention for a heterogeneous adolescent clinical population

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Abstract

Objectives: Mindful Awareness and Resilience Skills for Adolescents (MARS-A) is a mindfulness-based intervention adapted for the adolescent population. While previous studies have explored the benefits of MARS-A in various single-diagnosis populations, the aim of this study was to assess MARS-A for a heterogeneous clinical adolescent population with mental health and/or chronic diagnoses, focusing on the underlying suffering present in all these conditions rather than its effects on a single diagnosis itself.

Methods: Qualitative data was collected through interviews to understand post-intervention participant perspectives and experiences. Quantitative data was collected through measures to investigate preliminary secondary outcomes.

Results: After participating in MARS-A, participants reported qualitative benefits in enhanced well-being, including coping with difficult emotions and managing sleep and/or pain. Quantitative results showed a reduction in functional disability, psychological distress, perceived stress, and depressive symptoms; increase in positive affect; and benefit in coping with pain and chronic conditions.

Conclusions: MARS-A shows great potential in a heterogeneous clinical adolescent population.

Keywords: mindfulness; adolescents; chronic illness; mental health; chronic pain

*Corresponding author: Dr. Katarina Tabi, Centre for Mindfulness, BC Children's Hospital, Vancouver, Canada; BC Reproductive Mental Health Program, BC Women's Hospital and Health Centre, Vancouver, Canada; and Department of Psychiatry, The University of British Columbia, Vancouver, Canada, E-mail: katarina.tabi@cw.bc.ca

Dzung X. Vo, Centre for Mindfulness, BC Children's Hospital, Vancouver, Canada; BC Children's Hospital Research Institute, Vancouver, Canada; BC Children's Hospital, Vancouver, Canada; and Division of Adolescent Health and Medicine, Department of Pediatrics, Faculty of Medicine, University of British Columbia, Vancouver, Canada, E-mail: dvo@cw.bc.ca

Manreet Bhullar and Sophia Wang, Centre for Mindfulness, BC Children's Hospital, Vancouver, Canada; and BC Reproductive Mental Health Program, BC Women's Hospital and Health Centre, Vancouver, Canada. <https://orcid.org/0009-0003-8158-9645> (M. Bhullar)

Andrea Johnson, School of Social Work, The University of British Columbia, Vancouver, Canada

Jake Locke, BC Children's Hospital, Vancouver, Canada

S. Evelyn Stewart, Centre for Mindfulness, BC Children's Hospital, Vancouver, Canada; BC Children's Hospital Research Institute, Vancouver, Canada; Department of Psychiatry, The University of British Columbia, Vancouver, Canada; and BC Mental Health and Substance Use Research Institute, Vancouver, Canada

Sheila K. Marshall, Division of Adolescent Health and Medicine, Department of Pediatrics, Faculty of Medicine, University of British Columbia, Vancouver, Canada; and School of Social Work, The University of British Columbia, Vancouver, Canada

Introduction

Chronic health conditions and chronic pain are quite prevalent in adolescents, and pose a significant health burden. Globally, chronic illness affects one in 10 adolescents [1], and about 20.6 % of adolescents, on average, report weekly chronic pain in at least two sites. In Canada, 11.4 % of adolescents suffer from chronic headaches, 8.1 % suffer from chronic backache, 4.0 % suffer from stomach-ache, and 20.5 % suffer from multisite chronic pain [2].

Adolescents with chronic pain and/or chronic health conditions are at greater risk for mental health comorbidities. Existing adolescent literature has emphasized a relationship between many types of chronic conditions and mental disorders [3], and found a high co-occurrence of chronic pain or illness and mental health conditions, such as anxiety and depressive disorders [4]. Sometimes the chronic conditions precede the mental health conditions, though certain mental disorders can also serve as a risk factor for the development of chronic pain [3]. While the directionality of this relationship is not understood, there appears to be a commonality in the underlying suffering between chronic

health conditions, mental health comorbidities, and common distress related to both. Suffering is a crucial aspect of patient experience with illness, and is crucial to the practice of medicine, but difficult to objectively measure and treat [5].

In the face of illness and suffering, adolescents benefit from developing strategies to cope with their conditions and promote resilience. Resilience refers to “all the adaptive capacity available at a given time in a given context that can be drawn upon to respond to current or future challenges facing the individual” [6]. One strategy to promote resilience is mindfulness. Mindfulness is defined as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment by moment” [7]. Mindfulness practice is in part derived historically from Buddhism, which is an ancient tradition focused on alleviation of suffering [8]. Mindfulness can be cultivated and enhanced through Mindfulness-Based Interventions (MBIs), which are structured mindfulness-based training methods [9]. Prior research in schools have shown that MBIs contributed to stable levels of resilience in adolescents [10].

Mindfulness studies in adults suggest that MBIs have beneficial effects on pain tolerance and pain threshold [11], as well as mental health outcomes, such as depressive and anxiety symptoms, depression relapse risk, stress, and emotional or psychological distress [12]. Previous research looking into mindfulness meditation in adults with chronic pain found significant positive effects in vitality, pain acceptance, being in control of their pain, promoting psychological well-being, and reducing general anxiety and depressive symptoms [13]. A review study of mindfulness in physical diseases found that MBIs decrease stress and distress, while also improving quality of life for various chronic, stress-related diseases [14].

MBIs have more recently been adapted for adolescents, and have shown in early research to reduce anxiety and depressive symptoms, as well as improve quality of life for those with chronic pain [15]. Much of the adolescent mindfulness research has been conducted in school and community settings, and has been found to improve psychological functioning and potentially alleviate anxiety, depression, stress, and trauma [16, 17]. Adolescent MBI research in clinical settings has looked at mental health outcomes, such as anxiety or depressive symptoms [18], chronic pain [19], or chronic illness [20] individually, or focused on a chronic pain population or psychiatric population specifically [21, 22]. Prior research has largely not examined a clinically heterogeneous adolescent population. While previous studies looking at MARS-A in clinical adolescent populations have shown a benefit in somatic

symptoms and functional disability [23] and changing the way adolescents deal with their pain [24], adolescent MBI research to date has focused on specific conditions such as mental health symptoms or pain individually, rather than addressing the underlying suffering and distress present in both conditions. Due to the high co-occurrence of chronic health conditions and mental health conditions, an intervention is needed that could address the underlying suffering and distress in heterogeneous clinical conditions, and provide adolescents with a tool to cope with it.

The aim of this current study was to look at the potential of MARS-A, a novel mindfulness-based intervention, for in-person groups of a heterogeneous clinical adolescent population with anxiety, depression, chronic illness, and/or chronic pain. A secondary aim was to look at preliminary evidence for efficacy via outcomes including functioning, depressive symptoms, perceived stress, self-compassion, and positive and negative affect.

Methods

Development of a novel mindfulness-based intervention

MARS-A is an innovative 8-week (90 min each per weekly session), referral-based, outpatient program for adolescents aged 14–19 years with psychological distress (depression and/or anxiety symptoms), with or without co-occurring chronic illness and/or chronic pain. It was developed and facilitated by two experienced clinicians (D.V., Adolescent Medicine Specialist Pediatrician and J.L., Child and Adolescent Psychiatrist), who have formal adult MBI teacher training as well as extensive personal mindfulness practice experience. MARS-A is comprised of eight weekly sessions, 1.5 h each, plus a 4 h half-day of mindfulness (Table 1). MARS-A teaches formal and informal mindfulness meditation skills to cope with heterogeneous sources of distress and pain. MARS-A adapts elements from existing evidence-based mindfulness-based interventions for adults, including Mindfulness-Based Stress Reduction (MBSR) [8] and Mindfulness-Based Cognitive Therapy (MBCT) [25] (Table 2). The developers also integrated elements of their personal mindfulness practices and clinical practice with adolescents. Developmentally appropriate modifications were incorporated, for example shorter formal meditation practices, more concrete language for meditations and psychoeducation, developmentally appropriate examples of stress and coping, and emphasis on peer learning and community. MARS-A pilot groups were refined through three iterative cycles of participant oral and written feedback, prior to the collection of outcomes data reported here.

Participants

Participants were recruited from four cohorts of youth who registered for an outpatient in-person mindfulness group designed for adolescents (MARS-A) at a pediatric tertiary care hospital in a Canadian urban centre.

Table 1: MARS-A content outline^a

Session	Theme
1	Stress, depression and health – introduction to mindfulness for adolescents (psychoeducation on stress response in brain and body, definitions of mindfulness, introductory meditations)
2	Foundations of mindfulness (mindful qualities: beginner's mind, loving kindness, self-compassion)
3	Informal mindfulness practice and gratitude
4	Unpleasant experiences, physical sensations, physical pain (suffering=pain×resistance. Physical and mental pain are essentially similar. Practicing with suffering vs. focusing on pain)
5	Seeing thoughts as thoughts (adapted from MBCT)
6	Handling emotions (psychoeducation on emotions, riding emotions with mindfulness, meditations for handling strong emotions)
7	How to best take care of yourself (creating self-care and coping plans, integrating mindfulness)
8	Continuation of practice (motivational interviewing, goal setting for ongoing practice)
Half-day of mindfulness	Mini retreat, continuous formal mindfulness practices, mostly silent

Procedure

Ethics approval was obtained from the hospital research ethics board. Youth referred to the program by their regular medical or mental health provider were provided with information about the program and interviewed by a program physician or nurse. Youth were included in the program if they were between 15 and 19 years of age and experiencing current stable depression or past depression and/or a chronic health condition. Youth were excluded if there was active substance abuse, psychotic conditions, or acute suicidality. Separate from inclusion in the program was recruitment to the research study. Youth and parents received letters of invitation to the study. If interested, consent (parent) and assent (participant) forms were sent to their homes. After participant assent and parent/guardian consent forms were signed and received, adolescents were sent an online survey of measures prior to their participation in the MARS-A intervention group. They were asked to complete these measures within the week prior to the first session. Following completion of the 8-week MARS-A-group, participants were sent the same survey of measures to complete online. The

post-intervention data were collected approximately one week following the last session of the MARS-A intervention. Surveys were administered to participants through secure web-based software. Adolescents who completed the pre-test and post-test received a CAD \$10 gift card honorarium.

A semi-structured exit interview guide was developed specifically for this study. The interview questions were designed to generate information about how participants experienced the MARS-A program and what they noticed about their well-being and use of mindfulness in everyday life. Some research participants declined to engage in an exit interview and cited time constraints as a primary reason for non-participation. A total of 15 interviews were conducted.

Measures

Positive and negative affect: Positive and negative affect was measured with the 20-item Positive and Negative Affect Scale for Children (PANAS-C) [26], a widely-used child-version of the PANAS [27]. Positive

Table 2: Modifications from MBSR and MBCT to MARS-A.

MBSR, MBCT	MARS-A
MBSR: 8×2.5 h 1×7.5 h all-day session	Shorter sessions: 8×1.5 h sessions
MBCT: 8×2 h sessions	1×3 h half-day of mindfulness (optional)
For adult learners	Modified for youth audience
Emphasis on open curiosity	Emphasis on community building, fun, humor and spontaneity
Nondirective	Open curiosity
	Developmentally appropriate to offer guidance and brief teaching and reinforcement of key lessons and concepts with this population, integrated into inquiry
MBSR: Focus on mindfulness for stress management and pain for adults	Focus on mindfulness for psychological distress, suffering, physical and mental pain ^a
MBCT: Focus on mindfulness for chronic depression for adults	Youth-relevant metaphors and examples integrated throughout ^a
Formal and informal meditations, e.g., sitting meditation, walking meditation, body scan, eating meditation	Formal and informal meditations, similar to MBSR and MBCT
Length up to 45 min	Shorter practices, typically 3–20 min
	Language modified and adapted for youth audience – more concrete, less technical, at discretion of instructor ^a
Guided meditation recordings provided	Guided meditation recordings provided

affect is assessed with items: *excited, happy, strong, energetic, cheerful, active, proud, joyful, delighted and lively* and negative affect with items: *sad, upset, nervous, guilty, scared, miserable, afraid, lonely, mad and gloomy*. Participants are asked: *how much have you felt this way DURING THE PAST FEW WEEKS?* The response format ranges from 1 (very slightly or not at all) to 5 (a lot). In this study, reliability was assessed with Cronbach's alphas which were 0.94 at Time 1 and 0.94 at Time 2 for the positive sub-scale and 0.88 at Time 1 and 0.78 at Time 2 for the negative sub-scale.

Self-compassion: Self-compassion was measured with a 12-item version of the original 26 item Self Compassion Scale (SCS) [25]. The SCS measures the degree to which individuals display self-kindness against self-judgment, common humanity vs. isolation, and mindfulness vs. over-identification [28]. An example of an item on this scale includes: *I try to be kind towards those things about myself I don't like*. Participants were asked to respond to items using a 5-point Likert type scale ranging from 1 (never) to 5 (always); higher scores indicate greater compassion towards self. Cronbach's alphas were 0.87 at Time 1 and 0.87 at Time 2.

Life satisfaction: Life satisfaction was assessed with the 5-item Satisfaction with Life Scale for Children (SWLS-C) [29] adapted from the Satisfaction with Life Scale (SWLS) [30]. Participants rate the items using a 5-point Likert scale response format ranging from 1 (disagree a lot) to 5 (agree a lot); higher scores mean higher life satisfaction. Cronbach's alphas were 0.88 at Time 1 and 0.87 at Time 2.

Academic self-efficacy: Academic self-efficacy (ASE) are the beliefs of students regarding their mastery and skill competence within school settings. To measure ASE, six items from the Patterns of Adaptive Learning Survey (PALS) [31] that assessed the relationship between students' perceptions of school and their psychological and behavioral functioning in school were utilized to assess improvements in functional outcomes. An example of these items is: *I can do almost all the work in school if I don't give up*. Respondents indicate their beliefs on a Likert-response scale ranging from 1 (not at all true of me) to 5 (very true of me); higher scores indicate greater ASE. Cronbach's alphas were 0.90 at Time 1 and 0.88 at Time 2.

Perceived stress: The Perceived Stress Scale (PSS-10), is a widely used measure to assess the perception of stress [32] in general, not specific types of stress. An example item from this scale includes: *In the past month, how often have you felt that you were unable to control the important things in your life?* A Likert-type format ranging from 1 (never) to 5 (very often) was used. Cronbach's alphas were 0.87 at Time 1 and 0.92 at Time 2.

Psychological distress: To ensure coverage of a range of psychological symptoms, participants were administered assessments of psychological distress and depressive symptoms. Although there may be overlap between measures, the ability to track a range of symptoms was important given the variability within the sample. Psychological distress was measured using the 10-item Kessler Psychological Distress Scale (K10) [33]. The K10 is widely used as a brief screen of non-specific psychological distress. An example item is *In the last month, how often did you feel hopeless?* Participants responded to a Likert-type response

ranging from 1 (none of the time) to 5 (all of the time). Cronbach's alphas at Time 1 were 0.88 and 0.90 at Time 2.

Depressive symptoms: Depressive symptoms were measured with the Centre for Epidemiological Studies Depression Scale for Children and adolescents (CES-DC) [34]. This 20-item scale is a modified version of the CES-D and assesses the severity of depressive symptoms in children and adolescents in the non-clinical population. A sample item is: *I wasn't able to feel happy, even when my family or friends tried to help me feel better*. Participants used a Likert-response format to respond to individual items they experienced during the past week that ranged from 1 (not at all) to 4 (a lot). Cronbach's alphas were 0.92 at Time 1 and 0.94 at Time 2.

Mindful attention: Mindful attention was measured with the Mindful Attention Awareness Scale (MAAS). The 15-item MAAS assesses how mindful states vary over time for an individual [35]. The MAAS is focused on paying attention in the present rather than on qualities such as acceptance that is attributed to mindfulness. An example item is: *I find it difficult to stay focused on what's happening in the present*. Participants were asked to respond to items using a Likert-type response ranging from 1 (almost never) to 6 (almost always). Cronbach's alphas were 0.85 at Time 1 and 0.87 at Time 2.

Resiliency: Resiliency is understood as an ability residing within an individual to do well despite risk factors and difficulty [36]. Resilience was measured with the resilience inventory (RI) which assesses domains specifically relevant for youth [36]. This study used 14 items from the longer 44-item version [37]. An example item is: *more good things than bad things will happen to me*. Participants were asked how true each statement is for them, responding on a Likert-type format ranging from 1 (not at all like me) to 5 (always like me). Cronbach's alphas were 0.85 at Time 1 and 0.86 at Time 2.

Functional disability: Functional disability refers to impairment within physical activities and psychosocial functioning due to one's physical health status. The Functional Disability Inventory (FDI) [38] was administered because it is often used in research with young people experiencing chronic pain, as a marker of the impact of pain [39]. This measure is consistent with the goal of MARS-A, which is intended to alleviate suffering from pain, possibly independently from reducing pain per se [39]. This measure has 15 items: eight for physical activities and seven for psychosocial functioning. Examples of items include *walking up the stairs* (physical activities) and *being at school all day* (psychosocial functioning). Participants responded to how often they experienced any difficulty engaging in a specified activity in the last few days using a response format ranging from 1 (no trouble) to 5 (impossible). Subscale items were averaged separately. Cronbach's alphas for sub-scales were 0.91 (physical) and 0.82 (psychosocial functioning) at Time 1 and 0.93 (physical) and 0.88 (psychosocial functioning) at Time 2.

Exit interview: An exit interview guide was developed specifically for this study. The interview questions were designed to generate information about how participants experienced the MARS-A program and what they noticed about their well-being and use of mindfulness in everyday life. A total of 15 interviews were conducted.

Data analysis

Cross-case conventional content analysis [39] was used to analyze data from the semi-structured interviews. The purpose of the analysis was to identify themes reflective of participants' experiences of the MARS-A program, their sense of well-being in relation to the use of mindfulness exercises, and any hints of how they were currently using mindfulness. Phrases and themes were identified by one investigator (AJ) and discussed and checked by a second researcher (SKM).

The participants who were included in this study completed the majority of the survey items. Only one participant had missing items. Missing items ranged from 0–4.4 % (0–2 items) across measures. Rather than eliminating the case, the average of remaining items was used to estimate missing values.

Prior to conducting the analysis, the assumption of normally distributed difference scores was examined. This assumption was considered generally satisfied as the skew levels ranged between close to 0 to 1 [40].

To address the research question of the effects of a mindfulness intervention on the distress and wellbeing of adolescent participants, paired t-tests were conducted using bootstrapping (1,000 cycles). The t-tests compared changes in assessments before and after the MARS-A intervention.

Results

Quantitative findings

Across the four cohorts, 71 adolescents consented to study participation and participated in at least one study component. However, as the study is a pre and post-test design, only those adolescents who completed both of the assessments were retained as the analytic sample ($n=45$). This included 12 (27 %) males and 33 (73 %) females. The age of participants ranged between 14 and 18 years old. One participant did not

disclose their age. All but 3 (6 %) identified English as the language spoken at home. Forty-two (93 %) lived at home with one or both parents. Six (13 %) participants had previously participated in a mindfulness program.

The results of the paired samples t-tests are displayed in Table 3. Findings suggest improvements in well-being and functioning, including improvements in positive affect, self-compassion, depressive symptoms, perceived stress, resiliency, and functional disability (psychosocial).

Qualitative findings

Four central themes were identified through analysis of data from the semi-structured interviews: 'enhance well being', 'cope with difficult emotions', 'managing sleep and/or pain', and 'no longer in autopilot'. The themes described below showcase the connected sub-themes within the larger themes and representative quotes of each.

Key theme #1: enhance well being

Participants reported an enhanced sense of well being, particularly in the emotional, social, and intellectual dimensions of well being.

Sub-theme 1a: emotional well being

Participants reported feeling "happier and confident" after taking part of the group and felt that if they were "in a really tough period again, this would be something that would help [them] deal with that." They noted that when they recognize their thoughts are controlling them, "mindfulness has made [them] stop and relax and think – if I try this new thing, it will be ok, if I can't do something, no big deal."

Table 3: Pre- and post-intervention measures: results of bootstrapped paired samples t-tests ($n=45$).

Variable	Pre-test	Post-test	t	p	CI	Effect size
Bootstrapped means (SDs)						
Positive affect	2.49 (0.89)	2.98 (0.97)	−3.26	0.003	−0.714, −0.171	0.49
Negative affect	2.90 (0.87)	2.60 (0.83)	2.35	0.022	0.058, 0.561	0.35
Self-compassion	2.45 (0.68)	2.71 (0.66)	−3.22	0.003	−0.404, −0.098	0.48
Life satisfaction	2.73 (1.07)	2.93 (1.01)	1.43	0.140	−0.425, 0.060	0.21
Academic self-efficacy	3.79 (0.84)	3.74 (0.78)	0.38	0.705	−0.164, 0.258	0.06
Perceived stress	3.45 (0.67)	3.10 (0.79)	3.16	0.004	0.139, 0.543	0.47
Psychological distress	2.77 (0.86)	2.56 (0.84)	2.00	0.062	−0.009, 0.413	0.30
Depressive symptoms	2.49 (0.66)	2.27 (0.66)	2.09	0.048	0.010, 0.406	0.31
Mindful attention	3.37 (0.79)	3.23 (0.88)	1.15	0.242	−0.098, 0.386	0.17
Resiliency	2.96 (0.72)	3.20 (0.74)	−2.38	0.019	−0.383, −0.052	0.35
FDI, psychosocial	2.04 (0.85)	1.80 (0.82)	2.25	0.034	0.040, 0.455	0.34
FDI, physical activities	1.83 (0.89)	1.63 (0.83)	2.00	0.062	0.022, 0.438	0.30

SD, standard deviation; CI, confidence interval.

Sub-theme 1b: social well being

An enhancement in the social dimension of well-being was noted as well. In particular, one participant was able to “talk to friends everyday at home and at school.” They noted feeling less socially anxious and that they can “use mindfulness to feel more part of things” – as an example, when they “meditate with a body scan [they] can leave [their] room and feel better being around [their] family.”

Sub-theme 1c: intellectual well being

After taking part in the mindfulness group, participants noted positive effects in the intellectual dimension of well-being, particular seeing effects in school. Before the group, participants would “lose track of assignments & tests” or “didn’t go to school because [they] couldn’t sleep” and “couldn’t focus at school because [they] were so tired.” Participating in the group as made them “more attentive” and “more relaxed and able to focus more on school.”

Key theme #2: cope with difficult emotions

Participants noted they were better able to cope with difficult emotions, through an increased knowledge of strategies and feeling more in control of their emotions.

Sub-theme 2a: increased strategies

Participants said that learning new strategies, including body scanning and mindful listening, has helped them “deal with anxiety better now more than one way” vs. when some only had a single strategy to use.

Subtheme 2: feeling in control

By learning new strategies, participants felt more in control of their anxieties which helped them to better manage it. One participant noted they were “a bit anxious before [they] started MARS-A but [they] didn’t know that [they] could control this” but now “don’t feel anxious when [they] am using mindful listening”

Key theme #3. Managing sleep and/or pain

Through teachings learned over the course of the mindfulness group, participants found they were better able to manage sleep and/or pain through acceptance, which also helped them in other previously affected areas from their conditions.

Subtheme 3a: acceptance

Through the group, participants changed their mindset where they accepted that their “pain is always there but able to manage it a bit more.” Multiple participants mentioned

the body scan helped them be less affected by the pain, using it to “focus on different parts of the body and by the end [they] are not as worried about [their] pain even when it’s still there” and that it “helps [them] relax and not be so affected by [their] pain.” They also noted that the scan helped them get to sleep as they acknowledged the pain is “only temporary and it won’t stay with you forever.”

Subtheme 3b: improvements in other areas

The pain and/or sleep issues impacted adolescents’ ability to function in their daily lives and activities. Participants were “going to sleep around 3 AM and lying there and not sleeping because of the pain”, so they “didn’t go to school because [they] couldn’t sleep ... [they] couldn’t focus at school” due to how tired they were. However, using the body scan helped them feel “more relaxed and able to focus more on school”, noting that others saw the difference too.

Key theme #4. No longer in autopilot

Participants noted that after partaking in the group, they were no longer roaming about in autopilot. Further, being more aware and attentive of themselves and surroundings helped them be more aware of their own needs and how to take care of them.

Subtheme 4a: increased awareness/attention

From the strategies learned during the program, participants became more intentionally aware of their actions and surroundings, leaving behind their previous habits of “doing things like drawing or eating automatically without thinking about the moment.” They noticed themselves being more aware and attentive in interactions, as they would “clear [their] mind and focus on what they were saying ... as opposed to the other thoughts in my mind,” and in their activities they “would focus on that rather than being on auto-pilot.” One participant started using the STOP meditation when they wanted to pay attention, noting it felt like “another new brain was put into [their] mind – this practice had a huge impact on [their] life.”

Subtheme 4b: increased self-care

As a result of becoming more intentionally aware and attentive to themselves, participants noticed themselves being kinder to themselves and more understanding of their needs. One participant noted that participating in the group “influenced [them] to be able to be kinder to [themselves] and not push [themselves] to do something [they] didn’t want to do” and they now “can breathe and figure out what [they] to do and what [they] think.” Another participant makes it a

point to incorporate mindful eating during meals as it helps them “feel more calm during the day.”

Discussion

To our knowledge, this is the first study examining an MBI for adolescents with heterogeneous clinically significant levels of psychological distress, chronic illness, and/or chronic pain. MARS-A hopes to address the underlying suffering in these conditions, rather than focus on a particular symptom or diagnosis, (for example, reduce or eliminate pain *per se*). Inspired by the role of mindfulness in MBSR [41] and the Buddhist influences in mindfulness [8], MARS-A hopes to help adolescents develop a radically different relationship with pain, alleviate pain if possible, and more importantly, reduce suffering associated with pain and illness and help people function better and experience greater life satisfaction. “Suffering” is difficult to assess and measure objectively and quantitatively, but it is crucial to the experience of patients and to the practice of medicine [5]. Because of this, we are highlighting multiple measures of functioning, coping, and well-being that are supported by findings from qualitative analysis of interview data. This study found that adolescents who participated in MARS-A reported improved psychosocial functioning, more positive affect and self-compassion and resilience, reduced depressive symptoms and perceived stress, and qualitatively enhance well-being, emotional coping, and pain and sleep management.

Previous clinical studies of MBI for adolescents have looked at participants from more homogeneous populations, such as chronic illness [20, 42–44], chronic pain [24, 45, 46], anxiety [47, 48], or depression [49, 50], or mixed psychiatric diagnoses [21, 22] and found similar benefits in those populations. In a pilot study looking at MARS-A for adolescents with chronic pain, Lovas [23] found that somatic symptoms and functional disability improved at 3 months follow-up. Improvement in managing sleep is consistent with other studies [21, 24]. In a study of adolescents with Inflammatory Bowel Disease (IBD), Kohut [51] found improvements in emotional functioning and depressive symptoms. They also found that adolescents were able to use mindfulness in everyday life for both their IBD symptoms as well as other stressors. Kohut suggests focusing on improved psychological distress and suffering as appropriate goal outcomes, which is consistent with MARS-A.

This study used functioning as an outcome proxy for the impact of pain and pain management, and found MARS-A helped adolescents to cope with pain and reduce functional disability. This is consistent with Ali [52] who found an

improvement in FDI scores, pain, anxiety, and functioning; and Lovas [23] who found an improvement in somatic symptoms and FDI scores.

Ruskin et al. [46] found an increase in pain acceptance, which has been previously found to be a predictor of disability in adolescents with chronic pain. They reported that after an 8-week MBI-A group, adolescents found they learned to “let go of the pain” instead of trying to “get rid of the pain” and acknowledged the pain rather than expending energy resisting or distracting themselves from the pain which allowed them to move forward despite the pain. This shift in how they perceived pain “helped them with the emotional aspects of pain, rather than the physical pain sensations” [53], which suggests there may be an advantage for an MBI such as MARS-A that is for a heterogeneous population rather than focused on pain. Chadi’s study on MARS-A [24] found a difference in the way adolescents coped with pain, with one participant expressing “my pain isn’t less intense, but my relation to it has changed. Now I am able to live and respond to my pain more easily.” This is similar to our findings and consistent with the MARS-A intention to change how people relate pain even if the pain does not go away.

Unlike our study, Ruskin [46] saw an increase in FDI scores in adolescents with chronic pain. Potential explanations they offered were that participant socialization reinforced these disability behaviours. When the population consists only of a single diagnosis, such as chronic pain, it may increase the reinforcement of disability behaviours or identity. Unlike Ruskin’s chronic pain (single diagnosis) population, our study was with a heterogeneous population of chronic pain, chronic illness, and psychological distress. We suggest that a holistic MBI with a heterogeneous population that was not focused on pain could be beneficial to heterogeneous clinical adolescent populations, including those who do suffer from chronic pain.

We found a reduction in depressive symptoms, consistent with previous studies [15, 21, 54]. We also found an increase in positive affect, consistent with previous studies [41]. Positive affect includes positive emotions like joy and gratitude and/or positive moods [55], and refers to the pleasurable engagement with the environment [56], which is conceptually consistent with the intention of mindfulness to appreciate and savor positive emotions [57] as well as to cope with distress and suffering.

Relief of suffering is a relatively neglected area within medicine, but is a primary focus of Buddhist traditions from which MBIs are historically derived [8]. On suffering in medicine, Cassel [58] writes (emphasis added): “Suffering can include physical pain but is by no means limited to it. The relief of suffering and the cure of disease must be seen as

twin obligations of a medical profession that is truly dedicated to the care of the sick. *Physicians' failure to understand the nature of suffering can result in medical intervention that (though technically adequate) not only fails to relieve suffering but becomes a source of suffering itself.*" Therefore, rather than limiting intake to adolescents labeled with a single diagnosis or symptom, intake criteria for the MARS-A program reported here reflected the underlying distress that this intervention aimed to address. By broadening intake criteria to the common psychological distress experienced via various diagnoses, youths that may not have a formal psychiatric diagnosis or do not identify with the diagnosis received are still able to partake in this program and reap the benefits. Psychological distress also relates to the shared suffering that MARS-A addresses. In addition to reduced psychological distress, a reduction in perceived stress was also found, which are consistent with previous studies [21, 59].

Limitations and future directions

A major limitation of this study is that it was an uncontrolled pre-post open trial. Results from this study are not generalizable as without a comparable control group, no conclusions or causations can be inferred, only correlations can be observed. Further, it cannot be ruled out that other aspects of the adolescents' experience, including medications, additional therapy, social support, external stressors, etc., may have contributed to the observed changes. As well, all the measures used were self-report which introduces subjectivity.

No statistically significant change was found with the quantitative measurement of mindful attention, reflecting the debate surrounding the limitations and bias of self-report measures in mindfulness literature. Measures including mindful attention may not fully capture the multifaceted nature of mindfulness [60, 61]. Incorporating non-self-report measures to complement self-assessments [60] could provide valuable insights into the interpretation of non-significant changes in quantitative measurements of mindful attention [62].

Future studies should include a larger RCT study with an appropriate control group for MBI which would help researchers generalize results and enhance the strength of the evidence. Although there were some significant findings this report, research is currently limited by small numbers and power. Future studies are recommended to include larger sample sizes and more advanced measures [63], including second-person reports from other members in the adolescents' life, such as parents, guardians, healthcare

providers, etc., as well as nonself-report measures, including behavioral and physiological measures such as salivary cortisol [61] or heart rate variability. Further, the Covid-19 pandemic restrictions brought on an increased usage of e-health thus it would be beneficial to also look at MARS-A delivered over a virtual health platform. Studies have found that e-health is acceptable [60, 64] and have recommended virtual health delivery of adolescent mindfulness-based interventions [65]. There still remains a gap in health outcomes for the e-health format which needs to be looked at.

Conclusion

This pilot study shows great potential for MARS-A as an MBI for a heterogeneous adolescent clinical population. Rather than focusing on a specific diagnosis or symptom, this intervention highlights the common underlying suffering experienced by adolescents with psychological distress, chronic pain, and/or chronic illness. Mindfulness may be a promising approach to addressing this common suffering among adolescents in clinical settings.

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Research ethics: The study has received ethics approval from the University of British Columbia Children's and Women's Research Ethics Board (number H11-01416).

Informed consent: Written informed consent was obtained from all participants included in this study. For participants under age 19, written informed consent was obtained from the parent or guardian, and verbal informed assent was obtained from the participant.

Author contributions: DV, SKM, JL conceptualized and designed the study. DV, KT, MB, SKM were in charge of project coordination and task planning. MB and DV conducted the literature search, and AJ and SKM collected and analyzed data. DV, KT, SKM, MB, AJ, JL interpreted results and brainstormed about themes for discussion. MB,

KT, DV drafted outlines for the manuscript, and MB, DV wrote the initial manuscript drafts. SKM, MB, KT, DV, SES edited the manuscript and MB, SW managed references and final formatting. SW, MB, and KT completed paper revisions after the peer-review, drafted the letter to the editor, and submitted the manuscript. This research study was conducted under supervision and mentorship from SKM and SES. All authors have accepted responsibility for the entire content of this manuscript and approved its submission.

Competing interests: Dzung Vo receives book royalties for *The Mindful Teen: Powerful Skills to Help You Handle Stress One Moment at a Time* (New Harbinger Publications). Dzung Vo also receives royalties for use of guided meditations on the Insight Timer app. Other co-authors state no conflict of interest.

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Data availability: The data that support the quantitatively analyzed findings of this study are available upon request from the corresponding author. However, participants of this study did not give written consent for their interview data to be shared publicly, so the supporting data for the qualitative analysis is not available.

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